Original Article

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Nutrition Section

Assessment of Nutritional Status and its Determinants among Under-five Children in Urban Slum Areas of Gwalior City, Central India

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ABSTRACT

Introduction: Children living in urban slums are vulnerable to malnutrition due to lack of basic health facilities and poor environmental conditions. These make children susceptible to infectious diseases. Data on the correlates of stunting, underweight and wasting specifically among under-five children in central India remain limited, hence the need of this study.

Aim: To study the prevalence of underweight, stunting, and wasting with its predictors in under-five children living in slum area.

Materials and Methods: It was a community-based cross-sectional study, carried out from March 1, 2018 to February 28, 2019, slum area of Gwalior City, Madhya Pradesh, India, using multistage sampling. Study subjects were under-five children residing in urban slums. Data collection was done by conducting house to house survey and information was recorded in predesigned questionnaire. Mean, Standard Deviation (SD), frequency and percentage were calculated. Logistic regression was applied to calculate Odds Ratio (OR, 95% CI). Data was analysed using version Statistical Package for Social Sciences (SPSS) -16.

Results: A total of 550 children (257 boys, 293 girls) under-five years of age were included in the study. The overall prevalence of underweight was 49.1%, stunting was 58.2% and wasting was 23.5%. The risk of underweight, stunting and wasting was less among others caste category (OR:0.42,0.27,0.49). The risk was higher among children living in nuclear family (OR:1.86,1.78,1.72), with illiterate mother (OR:6.47,4.87,3.53), with illiterate father (OR:4.60,3.65,1.99) and also among people living in kuccha house and using wood as medium of cooking food. Duration of breastfeeding, complementary feeding only, timing of initiation of complementary feeding and birth weight emerged as other significant predictors for underweight, stunting and wasting.

Conclusion: Children with low birth weight, belonging to lower socio-economic class, living in nuclear families and having illiterate parents require special attention and focus. Parents should also be careful in reference to their children's complementary feeding and duration of breastfeeding.

Keywords: Feeding, Prevalence, Stunting, Underweight, Wasting

INTRODUCTION

Children suffering from malnutrition create a marginalised group with significant disadvantage of under-five mortality. Malnutrition increases susceptibility to infections such as respiratory infections, diarrhoea, malaria and other co-morbidities. It is not only an important cause of childhood morbidity and mortality, but also leads to impairment of physical and mental growth of a child significantly [1]. Appropriate child feeding behaviour goes a long way in preventing and overcoming malnutrition and determining a child's growth [2]. An individual experiences malnutrition if the appropriate amount of, or quality of nutrients comprising for a healthy diet are not consumed for an extended period of time. Timely quality care and appropriate treatment are needed for children who are affected by malnutrition so that they achieve their full potential and physical growth [3].

Considering the index study location, according to the National Family Health Survey (NFHS-4, 2015-16), 48.5% of under five-year children in Gwalior district were underweight (low weight for age), while the prevalence for the same in Madhya Pradesh was 42.8% and 35.7 % at all India level. Stunting was 42.8% in Gwalior while the prevalence in Madhya Pradesh was 42% and 38.4 % at all India level. Wasting was 28% in Gwalior while in Madhya Pradesh it was 25.8% and 21.0% at all India level. Severe wasting was 11.1% in Gwalior while in Madhya Pradesh, it was 9.2 % [4]. The above comparative data shows compelling situation in Gwalior. Approximately one third of the population of Gwalior lives in slums, with no access to basic services such as water and sanitation [5].

Under-nutrition is an underlying factor in many diseases in both children and adults, and it contributes greatly to the disability-adjusted life years worldwide [6]. Childhood undernutrition has frequently been cited as an indicator to measure the development of a nation as it reflects how the most vulnerable group is treated; and is used as an indicator to measure progress toward the Sustainable Development Goals (SDG 2) which aim to end hunger, achieve food security and improved nutrition by 2030 [7-9].

Despite implementation of several national programmes, nutritional status of slum children has not improved much. Not only lack of food but also other socio-demographic and maternal child care factors seem to be contributory factors in determining the nutritional status of children [10]. Back in 2004, it is projected that more than half of the Indian population will live in urban areas by 2020 and nearly one third of this urban population will be of slum dwellers [11]. The urban population in India was estimated to be 59.1 crores in 2020 while it would be 65.8 crores by 2025, as mentioned in the United Nation's report [12]. The rapid urbanisation negatively impacts the health and nutrition among children [11]. Under-nutrition in young children has long-term negative effects on physical and cognitive development. Very scarce data is available on the nutritional assessment among under-five children living in slum area of Gwalior city. Study conducted by Bhatia M et al., included health functionaries whereas the study conducted by Hegde S and Gaur A, was a hospital-based study [13,14].

Considering the situation, it was the felt need to discuss the issue comprehensively regarding various factors contributing to the

undernutrition and therefore to address the problem in depth, the present study was done. Hence, the study aimed to find out the prevalence of underweight, stunting, and wasting and its associated epidemiological predictors among under-five children of urban slums. The authors have a published article on the same population, that was based on the prevalence of undernutrition; while this article reveals the prevalence of underweight, stunting and wasting separately along with their determinants [15]. It is important to make strategies for the prevention according to the type of undernutrition.

MATERIALS AND METHODS

This study was a community-based, cross-sectional study undertaken among the under-five children, living in urban slums of Gwalior City of Madhya Pradesh state of India. The duration of the study was from 1st March 2018 to 28th February 2019. The study was approved by the Institutional Ethical Review Committee of G.R. Medical College, Gwalior; M.P. (Letter number: D.NO. 506 /Bio/MC/Ethical). Informed written consent was obtained from the parents of children in selected households.

Inclusion criteria: Children from 6 months of age to under-five years and whose parents gave consent to participate in the study were included.

Exclusion criteria: Children of unwilling parents and those who were severely ill were excluded from the study.

Sample size calculation: The prevalence of underweight children was 42.8% (reports of NFHS-4; 2015-16) [16] and at 95% confidence interval with 10% relative error. The sample size was estimated by using formula; N=4PQ/L2 [17]. The minimum sample size estimated for the study was 535, which was rounded off to 550 for under-five children.

Study Procedure

The study population was selected using multistage sampling technique. List of wards was obtained from the Municipal Corporation, Gwalior. There are a total of 66 wards. For study purpose, 25 urban slum areas were selected randomly. From each slum area, 22 under-five eligible children were selected by using simple random sampling; so that the desired sample size of 550 was met.

A questionnaire was formulated. To determine the content domain for questionnaire, an extensive review of literature was conducted. Literature review helped the researchers in identification of various research gaps in the foundation of the construct. The stage of judgement involved confirming the items by four experts of community medicine and nutrition to ensure content validity of the assessment instrument. Selection of the domain experts was done on the basis of criteria such as expert knowledge, specific training or professional experience on the subject matter.

Household survey was done. A pilot study was done and the questionnaire was finalised in local (Hindi) language. Data was collected using a semi structured, pre-designed questionnaire schedule by personal interview method. Information on household's socioeconomic and demographic particulars was collected in all the selected households. Mothers were considered for the interview. Caste category was divided based on Madhya Pradesh government gazette [18,19]. Modified BG Prasad Classification was used to classify socio-economic condition [20].

Anthropometric measurements, such as length (up to nearest 1 mm with stadiometer SECA 213) and weight (up to nearest 100 g using a SECA weighing scale) of the children, were obtained using standard anthropometric equipment and procedures. The nutritional status of children was assessed according to Standard Deviation (SD) classification of World Health Organisation (WHO) measuring Change in Nutritional Status [21] (Geneva, Switzerland: WHO; 1983). Children with length/height-for-age below -2 SD of the WHO [22] standards were labelled as stunted; children with weight-for-age below -2 SD of the WHO standards were identified as underweight and weight for height indices below -2 SD were classified as wasting.

STATISTICAL ANALYSIS

The data were scrutinised and entered into the Microsoft excel sheet and data cleaning was done by carrying out range and consistency checks. Descriptive and analytical statistics of the data were carried out using SPSS Windows version 16.0. Chi-square test was performed to see association between the variables. The p-value <0.05 was considered significant. Binary logistic regression analysis for outcome variables such as underweight, stunting and wasting with all the independent variables was carried out to study the association in terms of odds ratio.

RESULTS

A total of 550 children (male: 257, female: 293) under-five years of age were analysed in this study. Mean age of the children (in months) was 33.33±15.86. The distribution of the population based on type of undernutrition is presented in [Table/Fig-1].

Undernutrition	N (%)	Age (months) (Mean±SD)	Gender (male (%)/female (%))
Underweight	270 (49.1)	32.85±15.67	130 (48.1%)/140 (51.9%)
Stunting	320 (58.2)	33.23±15.63	155 (48.4%)/165 (51.6%)
Wasting	129 (23.5)	32.05±16.19	74 (57.4%)/55 (42.6%)

[Table/Fig-1]: Prevalence of undernutrition.
N in the table is heigher than total no. of subjects since inclusion of each subject in more than one category

Underweight: In the present study, the total prevalence of underweight was significantly associated with children belonging to Other Backward Class (OBC), Scheduled Caste (SC) and Scheduled Tribe (ST) caste, living in nuclear families, having illiterate parents and belonging to poor socio-economic group. In logistic regression analysis, it was found that children belonging to 'others' caste were at lesser risk as compared to those belonging to SC/ST. Those living in nuclear family had 1.8 times more risk as compared to those living in joint family. Children whose mothers were either illiterate or having primary education had nearly 6 times more risk as compared with children whose mothers were graduate or more. Children whose fathers were illiterate had 4.6 times more risk as compared with those whose fathers were graduate or more [Table/Fig-2]. Regarding the profession of father, as compared with unskilled worker, the risk of underweight was significantly less among children of fathers having other profession such as professional/semi-professional, clerical/shop-owner, skilled worker and semi-skilled worker. Children living in kuccha houses were at 3.49 times more risk as compared to those living in Pucca houses. Children were found 2.46 times more prone to underweight where firewood was used as medium of cooking food as compared to LPG. Initiation of breastfeeding within one hour of birth emerged as protective factor. Number of complementary feeds <4 per day was an important factor significantly affecting the weight of the child [Table/Fig-3]. Low birth weight (<2.5 kg), caesarean delivery, total number of antenatal visits, number of Iron Folic Acid (IFA) tablets consumed by mothers during pregnancy were significant determinants [Table/Fig-4].

Stunting: Prevalence of stunting among male and female was 60.3% and 56.3%, respectively. The prevalence of stunting was significantly higher (p<0.05) among children belonging to OBC, SC and ST community, living in nuclear families, among those children whose mother and father were illiterate and primary educated, whose fathers were unskilled and semi-skilled worker, those belonging to lower and lower middle Socio-economic Status (SES) and using wood as a medium for cooking food [Table/Fig-2]. Occupation of mother of the children was not found to be associated with stunting. General and OBC caste children were at less risk as compared with SC/ST children. As the education of mother increases risk of stunting starts declining, for illiterate mother it was 4.87 times which declined to 2.47 for intermediate educated mother as compared with graduate mother. Similar findings were reported for education of father. As compared to graduate fathers, risk of stunting among children with illiterate fathers

Variables		n	Underweight OR (CI)	Stunting OR (CI)	Wasting OR (CI)
Gender	Male	257	1.12 (0.80-1.56)	1.18 (0.84-1.66)	1.75 (1.17-2.61)
	Female	293	1 (ref)	1 (ref)	1 (ref)
Religion	Muslim	116	1.42 (0.94-2.15)	1.12 (0.74-1.70)	1.05 (0.65-1.69)
	Hindu	434	1 (ref)	1 (ref)	1 (ref)
Caste	Others	73	0.42 (0.24-0.75)	0.27 (0.15-0.47)	0.49 (0.22-1.12)
	OBC	297	0.97 (0.67-1.41)	0.54 (0.37-0.80)	1.60 (1.03-2.50)
	SC/ST	180	1 (ref)	1 (ref)	1 (ref)
Type of family	Nuclear	285	1.86 (1.32-2.61)	1.78 (1.26-2.51)	1.72 (1.15-2.58)
	Joint	265	1 (ref)	1 (ref)	1 (ref)
Education of mother	Illiterate	109	6.47 (3.07-13.65)	4.87 (2.45-9.69)	3.53 (1.38-9.05)
	Primary school	107	6.81 (3.22-14.41)	3.23 (1.65-6.31)	3.47 (1.35-8.91)
	Middle school	149	3.32 (1.63-6.78)	2.39 (1.27-4.50)	2.61 (1.03-6.59)
	High school	79	2.17 (0.99-4.76)	2.00 (0.99-4.02)	1.67 (0.59-4.71)
	Intermediate	49	2.81 (1.20-6.59)	2.47 (1.12-5.41)	2.73 (0.95-8.02)
	Graduate/Postgraduate	57	1 (ref)	1 (ref)	1 (ref)
Education of father	Illiterate	99	4.60 (2.20-9.62)	3.65 (1.77-7.52)	1.99 (0.88-4.47)
	Primary school	97	2.62 (1.27-5.39)	4.73 (2.26-9.90)	1.11 (0.48-2.59)
	Middle school	149	1.77 (0.90-3.50)	2.29 (1.17-4.50)	1.21 (0.55-2.67)
	High school	100	1.23 (0.59-2.53)	2.06 (1.01-4.18)	0.83 (0.35-1.98)
	Intermediate	57	1.26 (0.56-2.81)	2.17 (0.99-4.78)	0.71 (0.26-1.93)
	Graduate/Postgraduate	48	1 (ref)	1 (ref)	1 (ref)
Socio-economic status	Upper and Upper middle	54	0.38 (0.19-0.76)	0.46 (0.23-0.92)	1 (ref)
	Middle	131	0.76 (0.44-1.30)	0.72 (0.42-1.24)	0.63 (0.28-1.45)
	Lower middle	274	0.86 (0.53-1.39)	1.04 (0.64-1.69)	0.86 (0.47-1.60)
	Lower	91	1 (ref)	1(ref)	0.85 (0.49-1.47)

[Table/Fig-2]: Logistic regression analysis of predictors influencing underweight, stunting and wasting.

Particular	n	Underweight	OR (CI)	Stunting	OR (CI)	Wasting	OR (CI)
Initiation of breastfeeding (hours)							
<1	130	46 (35.4)	0.52 (0.29-0.92)	36 (46.2)	0.52 (0.29-0.92)	16 (12.3)	0.28 (0.14-0.57)
2-4	342	184 (53.8)	1.11 (0.68-1.81)	203 (59.4)	0.88 (0.58-1.33)	87 (25.4)	0.68 (0.40-1.16)
5-11	78	40 (51.3)	1(ref)	81 (62.3)	1 (ref)	26 (33.3)	1 (ref)
Duration of breastfeeding (age in months)							
≤6	39	30 (76.9)	4.03 (1.78-9.13)	27 (69.2)	1.42 (0.66-3.04)	11 (28.2)	1.46 (0.65-3.28)
7-12	81	46 (56.8)	1.59 (0.91-2.76)	48 (59.3)	0.92 (0.52-1.61)	33 (40.7)	2.56 (1.40-4.68)
13-24	237	108 (45.6)	1.01 (0.66-1.54)	127 (53.6)	0.73 (0.47-1.12)	47 (19.8)	0.92 (0.55-1.55)
25-35	56	24 (42.9)	0.91 (0.48-1.70)	34 (60.7)	0.97 (0.52-1.84)	9 (16.1)	0.71 (0.31-1.62)
≥36	137	62 (45.3)	1 (ref)	84 (61.3)	1 (ref)	29 (21.2)	1 (ref)
Number of complementary feeds per day							
<4	157	65 (41.4)	0.65 (0.45-0.94)	92 (58.6)	1.02 (0.70-1.49)	42 (26.8)	1.28 (0.84-1.97)
≥4	393	205 (52.2)	1 (ref)	228 (58.0)	1 (ref)	87 (22.1)	1 (ref)
χ^2, **p-value**		5.20, **0.024**		0.02, 0.924		1.33, 0.266	

[Table/Fig-3]: Association between infant and young child feeding practices and the prevalence of undernutrition.

was 3.65 times and 2.17 times for intermediate educated fathers. Professional, clerical and skilled worker were at less risk as compared with unskilled worker. Those belonging to upper and upper middle class were at significantly less risk as compared with lower SES. Children living in Kuccha houses were at 2.01 times more risk as compared to those living in Pucca houses. Children were found more prone to stunting i.e., 1.78 times where firewood was used as a medium of cooking food as compared with LPG [Table/Fig-2]. Feeding of colostrum (Not given; OR: 0.59; CI:0.26-1.35), Initiation of complementary feeding (<6 months) were insignificant factors. Low birth weight was significant risk factor for stunted child. Caesarean delivery was a protective factor for stunting. Mothers who consumed less than 90 Iron Folic Acid (IFA) tablets during pregnancy had children who were 1.7 times more prone to risk of stunting [Table/Fig-4].

Wasting: Prevalence of wasting among male and female was 28.8% and 18.8%, respectively. The prevalence of wasting was more among Muslims (24.1%) and OBC caste (28.6%). The prevalence of wasting was significantly higher ($p<0.05$) among male children, belonging to OBC, SC and ST community, living in nuclear families and also among those children whose mothers and fathers were illiterate or primary educated, those living in kuccha houses and using wood for cooking food. Occupation of mother of the children was not found to be associated with wasting. Male children had 1.75 times more risk of wasting as compared to female children. Surprisingly, OBC caste children were at more risk as compared to SC/ST children. Those living in kuccha houses were at more risk as compared with children living in pucca houses. Children with households using fire wood as type of cooking fuel were at 3.95 times more risk as compared with

Particular	N	Underweight	OR (CI)	Stunting	OR (CI)	Wasting	OR (CI)
Parity							
First	130	52 (40.0)	0.56 (0.28-1.11)	74 (56.9)	0.68 (0.33-1.39)	21 (16.2)	0.58 (0.25-1.32)
Second	269	141 (52.4)	0.92 (0.48-1.74)	152 (56.5)	0.67 (0.34-1.31)	67 (24.9)	0.99 (0.48-2.08)
Third	107	53 (49.5)	0.82 (0.40-1.65)	65 (60.7)	0.80 (0.38-1.67)	30 (28.0)	1.17 (0.52-2.61)
≥Fourth	44	24 (54.5)	1 (ref)	29 (65.9)	1 (ref)	11 (25.0)	1(ref)
χ^2, **p-value**		6.02, 0.111		1.76, 0.623		5.49, 0.140	
Birth weight							
< 2.5 kg	187	117 (62.6)	2.29 (1.60-3.29)	120 (64.2)	1.46 (1.01-2.10)	65 (34.8)	2.49 (1.66-3.73)
≥ 2.5 kg	363	153 (42.1)	1(ref)	200 (55.1)	1 (ref)	64 (17.6)	1(ref)
χ^2, **p-value**		20.59, **<0.05**		4.177, **0.045**		20.17, **<0.05**	
Total under-5 children in family							
1	282	134 (47.5)	0.88 (0.63-1.23)	167 (59.2)	1.09 (0.78-1.53)	59 (20.9)	0.75 (0.50-1.11)
> 1	268	136 (50.7)	1 (ref)	153 (57.1)	1 (ref)	70 (26.1)	1(ref)
χ^2, **p-value**		0.58, 0.449		0.256, 0.613		2.068, 0.150	
Total no. of antenatal visits							
1	7	4 (57.1)	2.29 (0.47-11.22)	5 (71.4)	1.95 (0.35-10.92)	3 (42.9)	2.81 (0.55-14.31)
2	57	40 (70.2)	4.03 (1.84-8.82)	37 (64.9)	1.44 (0.68-3.07)	29 (50.9)	3.88 (1.71-8.33)
3	235	111 (47.2)	1.53 (0.85-2.78)	147 (62.6)	1.30 (0.73-2.34)	37 (15.7)	0.70 (0.33-1.45)
4	194	94 (48.5)	1.61 (0.88-2.96)	99 (51.0)	0.81 (0.45-1.47)	48 (24.7)	1.23 (0.60-2.53)
≥5	57	21 (36.8)	1 (ref)	32 (56.1)	1 (ref)	12 (21.1)	1 (ref)
χ^2, **p-value**		14.10, **0.006**		7.59, 0.108		33.49, **<0.05**	
Type of delivery							
CS	154	56 (36.4)	0.49 (0.33-0.71)	76 (49.4)	0.61 (0.42-0.88)	27 (17.5)	0.61 (0.38-0.98)
Normal	396	214 (54.0)	1 (ref)	244 (61.6)	1 (ref)	102 (25.8)	1 (ref)
χ^2, **p-value**		13.86, **<0.05**		6.86, **0.009**		4.18, **0.041**	
No. of Iron Folic Acid (IFA) tablets consumed during pregnancy							
<=60	76	55 (72.4)	4.54 (2.58-7.99)	49 (64.5)	1.76 (1.03-2.99)	35 (46.1)	3.26 (1.89-5.64)
61-90	228	125 (54.8)	2.10 (1.46-3.04)	146 (64.0)	1.72 (1.19-2.49)	43 (18.9)	0.89 (0.56-1.40)
>90	246	90 (36.6)	1 (ref)	125 (50.8)	1(ref)	51 (20.7)	1 (ref)
χ^2, **p-value**		34.87, **<0.05**		9.94, **0.007**		25.31, **<0.05**	

[Table/Fig-4]: Association between maternal care indicator and the prevalence of undernutrition.

Liquefied Petroleum Gas (LPG) using households [Table/Fig-2]. In this study, risk of wasting was less among those children in whom initiation of breastfeeding started early (<1 hour) as compared with those where initiation of breastfeeding started in 5-11 hours after birth [Table/Fig-4]. Colostrum given/not given (Not given; OR: 0.64; CI: 0.21-1.91) and Immunisation status of child (Completely Immunised; OR: 0.66; CI:0.41-1.07) were found as insignificant risk factors. Low birth weight was found to be a significant risk factor. Risk was significantly less among those family where total under-5 children in family were less as 1 or 2 (for 1 child, OR: 0.26(0.10-0.66)): and for 2 children: 0.32(0.13-0.80). First born child was at less risk of wasting. Caesarean delivery was found to be a protective factor for stunting. Children with mothers consuming less than 60 IFA tablets were 3.26 times more prone to risk of wasting [Table/Fig-4].

DISCUSSION

The present study, carried out in urban slum, revealed that the prevalence of underweight, stunting and wasting was 49.1%, 58.2% and 23.5%, respectively. The NFHS -4 (2015-16) reported that prevalence of underweight, stunting and wasting was 48.5%, 42.8% and 28.0%, respectively, in Gwalior city [23]. As compared with NFHS-4, this study reported rise in stunting while fall in wasting.

Studies carried out earlier in the slums of Hyderabad by Peter R and Anil Kumar K reported the prevalence of stunting and underweight as 39.8% and 33.5%, respectively [24]. Dhatrak PP et al., conducted study in urban slum of Nagpur and found that 35% children were underweight, 22.7% were stunted and 12.7% were wasted [25]. Study conducted in Pune found that the percentages of children who were underweight, stunted and wasted were 34.3%, 58.7% and 16.9%, respectively [26]. A study conducted in central India found prevalence of stunting amongst same children as 34.77% [27]. Study conducted in Raipur city of central India reported that 20.16% were underweight, 21.16% were stunted and 13.05% were wasted [28]. Kumar D et al., found that among under five children 36.4% were underweight, 51.6% were stunted and 10.6% were wasted [29]. In the index study, higher prevalence of underweight, stunting and wasting was observed as compared to the above studies.

In this study, male children were found significantly more wasted. Peter R and Anil Kumar K also reported the odds of male children being underweight to be 1.5 times as that of females [24]. Study conducted in Namin township in Ardabil Province of Iran and Field Ganj area of Ludhiana in Punjab reported that female gender had higher risk of child malnutrition [30,31]. Study conducted by Kodavalla V et al., reported high prevalence of stunting, wasting, underweight among children belonging to SC-ST community, residing in rural areas of Madhya Pradesh [32]. Research findings showed consistency with other studies by Singh H et al., Kumar D et al., and Avachat SS et al., [10,29,33].

As per UNICEF report, it was found that inequalities existed in nutrition across socio-economic groups. Higher prevalence of underweight, stunting and wasting among illiterate parents reflected that educated parents could do more efficient management of children care, they were much aware of nutritional knowledge of children and they could utilise healthcare services more. The findings of present study were supported by some other studies. For example, studies done by Kumar D et al., and Purohit L et al., supported the present findings

regarding stunting and underweight [29,34]. In the same way, studies done by Mittal A et al., and Giashuddin MS et al., supported the present findings in case of stunting and that of Swami HM et al., and Deshpande JD et al., in case of underweight [35-38].

Present study found that children whose fathers were engaged in semi-skilled or unskilled occupation were more prone to underweight and stunting. It might be due to their lower income and deprivation to provide quality foods to their family. The study findings reported that children living in kuccha houses and in households using fire wood as cooking medium were more prone to stunting, wasting and underweight. This implies that these children belong to low SES. Economic status is one of the most important factors providing the access to healthcare, education and nutritional facilities.

In this study, children in whom initiation of breastfeeding started early within one hour were at less risk for underweight, stunting and wasting. As the duration of breastfeeding started increasing from six months above the risk of underweight and wasting started declining. Kodavalla V et al., also found significant association between initiation of breastfeeding and the prevalence of underweight and wasting [32]. Higher prevalence of underweight was observed among children where initiation of breastfeeding was delayed beyond one hour. Dhatrak PP et al., and Sengupta P et al., found that lack of exclusive breastfeeding was statistically associated with malnutrition [25,31].

In this study, immunisation was not associated with underweight, stunting and wasting, similar result was reported by Sengupta P et al., [31]. It was seen that above the age of 6 months, as compared with complementary feeding only, mixture of breastfeeding with complementary feeding is a protective measure for underweight children. Children with birth weight <2.5 kg were significantly at more risk of stunting, wasting and underweight. Study conducted by Purohit L et al., Paul VK et al., Hien NN and Hoa NN, also found association with birth weight [34,39,40]. The present study found multiple predictors associated with underweight, stunting and wasting.

Limitation(s)

Data was obtained from the mothers regarding feeding practices, weaning, complementary feeding, antenatal care etc. Hence, recall bias was a major limitation.

CONCLUSION(S)

From this study done in Gwalior city, it can be concluded that the prevalence of stunting is high among children living in slums, belonging to OBC, SC and ST caste, among children of illiterate parents, those living in nuclear family, belonging to lower SES, children of parents engaged in unskilled work, living in kuccha houses and those using firewood as medium of cooking food. Important predictors that emerged for stunting, wasting and underweight were- infant up to 6 months of age receiving breast milk (not even water), number of complementary feeds, birth weight and type of delivery. It is the need of the hour to make nutritional intervention more effective with proper growth monitoring and nutritional education. It is recommended that improving maternal nutrition during pregnancy along with maternal education, improving sanitation and environmental hygiene, access to healthcare and supplementary feeding through proper implementation of Integrated Child Development Services (ICDS) will improve nutritional status of children. As the prevalence of undernutrition is high among children from SC and ST community, improving their socio-economic status by involving them in income generating activities will improve the purchasing power and thus nutritional status of their children.

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